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INTEGRATION INTO SUPPLY CHAIN NETWORKS IN MANUFACTURING FIRMS IN GHANA: THE EFFECT OF CHALLENGES

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ABSTRACT

In this paper, we examine the effects of three components or constructs of challenges on integration into supply chain networks after confirming them using Principal Component Analysis in a previous study. The study population was senor supply chain employees in selected manufacturing firms in Accra, Ghana. Simple random sampling technique was used to select 350 respondents. Data was collected using a self-administered questionnaire. The study's results indicate that the first component of challenges designated *micro-environment* negatively correlates to Integration, r (312) = -0.954, $p < .05$. Moreover, macro-environment challenges make a negative correlation with Integration, r (312) = r (312) = -0.799, $p < .05$. Technical challenges make a weak and negative correlation with Integration, r (312) = -0.395, $p < .05$. Moreover, each component/construct significantly predicts Integration at 5% significance level ($p < .05$). Micro-environment challenges account for 91% of the total variation, while macro-environment alone accounts for 4.6% of the total variation. Technical challenges account for 0.4% of the total variation. To maximise the effectiveness of integrating into supply chain networks, managements of manufacturing firms must remedy challenges found in each component based on the gravity of influence made by each of them.

KEYWORDS: Supply Chain, Supply Chain Management, Supply Chain Networks, Integration into Supply Chain Networks

INTRODUCTION

Manufacturing firms are noted for their high level of engagement in supply chain. This is logically because most or all of their activities are linked to either supplies of materials to the firm or distribution of finished goods to customers, sometimes through business intermediaries and other stakeholders. The high level of engagement in supply chain in manufacturing firms, the involvement of quite a number of stakeholders, processes and stages in it, and the expected connection among these stakeholders, processes and stages make it a network, generally called supply chain network (Chui, 1995; Awad & Nasser, 2010a). But what could be the role of this network in effective supply chain management (SCM)?

It is posited that a supply chain network constitutes an interconnected group of people (stakeholders) among which processes, activities, goods and services are relayed or transferred through the facilitation of information flow (Awad & Nasser, 2010a; Agyei, Sarpong & Anin, 2013). Without information, processes, activities, goods and services remain unmovable in the supply chain network. Primarily, the effectiveness of SCM depends on the strength of the supply chain network (Awad & Nasser, 2010b; Westbrook, 2002). Moreover, effectiveness of a supply chain network depends on how well the firm integrates into it (Westbrook, 2002; Skjott-Larsen & Bagchi, 2002). Nonetheless, entry into supply chain networks comes with challenges and threats to successful SCM.

Seemingly, there is agreement among researchers about challenges associated with integration into supply chain networks. In other words, empirical evidences point to a common set of challenges that firms face in integrating into supply chain networks. Awad & Nasser (2010a), Awad & Nasser (2010b), Carter, Monczka, Ragatz & Jennings (2009) and other researchers have revealed three components of challenges faced in integrating into supply chain networks. These components are: (1) organisational micro-environment challenges; (2) organisational macro-environment challenges; and (3) technical challenges. The first component comes with internal organisational issues that hinder connection with supply chain networks (Awad & Nasser, 2010a). The second component is composed of issues relating to the macro-economy, while the third component contains challenges associated with use of technology and data (Awad & Nasser, 2010a; Awad & Nasser, 2010b).

In our previous studies, we used Principal Component Analysis (PCA) to confirm these components of challenges. In this respect, the first component of challenges named *business micro-environment challenges* accounts for 53.7% of the variation. The second component of challenges named *business macro-environment challenges*, accounts for 27.6% of the variation. The third component of challenges constitutes technical challenges, and this accounts for 8.2% of the variation. Though this information gives a clue about the relative severity of each component and individual challenges found in it, our previous study could not contribute knowledge on the effect made by each component on integration into supply chain networks. As a result, much is not known about the nature of each component of challenges in our previous study.

In this paper, we assess the effect of each component on integration into supply chain networks among manufacturing firms in Ghana. Ordinary least squares (OLS) regression is used to make this assessment. The goal of the assessment is to provide a deeper outlook of challenges affecting integration into supply chain networks in manufacturing firms in Ghana.

OBJECTIVE OF THE STUDY

After using Principal Component Analysis (PCA) to confirm three components of challenges in our previous study relative to integration into supply chain networks, we use this study to assess the effect of each component on integration into supply chain networks in manufacturing firms in Ghana.

This study throws more light on the nature of effect made by challenges on integration into supply chain networks. The study provides empirical evidence on the prevalence of these challenges in Ghana considering the fact that academic debate on the subject in a Ghanaian context is very weak. The study therefore seeks to contribute to academic debate on the subject and enriches its literature from a Ghanaian perspective. Last but not least, this paper seeks to enrich practitioners and managements with knowledge about the challenges associated with integrating into supply chain networks, forming a basis for remedying these challenges in practice.

LITERATURE REVIEW

There are various definitions of supply chain. Chiu (1995), defines supply chain is a system of organisations, people, activities, information, and resources involved in moving a product or service from supplier to customer. A supply chain is also a network of organisations, people, activities, information, and resources that form the mechanism and process of conveying products and services to customers through suppliers (Enporion Inc, 2009). Activities of supply chain transform natural resources, raw materials, and components into a finished product that is delivered to the end customer

through a retailer (Chiu, 1995; Kuei & Madu, 2001). Apart from the definition of Sarpong et al. (2013), many other definitions of SCM exist. Supply chain management is also defined as the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders (Lambert, 2008). From a personal viewpoint, supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.

The basic goal behind a supply chain is to facilitate business activities towards organisational growth. This is because organisations recognise the need to rely on effective supply chains to compete in the local and global market place (Wagner et al., 2012; Okino & Cattini, 2011). Moreover, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies (Wagner et al., 2012). In view of this, the impact of SCM on the firm is said to be based on the effectiveness of integrating into supply chain networks (Westbrook, 2002; Georgise, Klause-Dieter & Seifert, 2014).

A supply chain network is the chain of people in the firm, its customers and suppliers and the processes binding them, through which goods and services are exchanged or transferred (Westbrook, 2002). Supply chain networks basically make up the core attribute of SCM and serve as an interconnected medium for the exchange and transfer of goods and services through the facilitation of information flow (Westbrook, 2002; Awad & Nasser, 2010a). A supply chain network could be the link among the various stakeholders in a proverbial supply chain process. Moreover, the role of the supply chain network depends on integration into it by the firm and other stakeholders such as customers, suppliers and business intermediaries (Awad & Nasser, 2010a; 2010b). Integration into a supply chain network means creating the right connections and links among people and processes to engender expected results (Awad & Nasser, 2010a). It also involves proper initiation, creation and management of the expected relationship among people (all stakeholders) and processes in SCM (Georgise et al., 2014).

Integration into supply chain networks is fraught with challenges. Therefore to ensure effective integration into supply chain networks, there is the need to hedge against its associated challenges (Awad & Nasser, 2010a; Agyei, Sarpong & Anin, 2013). Empirical studies have revealed a common set of challenges faced by firms in integrating into supply chain networks. The most recognised set of challenges are produced in the study of Awad & Nasser (2010a; 2010b). These researchers placed the challenges into components, namely (1) organisational micro-environment challenges; (2) organisational macro-environment challenges; and (3) technical challenges. These components of challenges have been empirically confirmed to have negative effects on integration into supply chain networks in foreign country contexts (Awad & Nasser, 2010a; Awad & Nasser, 2010b; Georgise et al., 2014). Table 6 in the appendix shows these components and their constituent elements. The first component comes with internal organisational issues that hinder connection with supply chain networks (Awad & Nasser, 2010a). The second component is composed of issues emanating from the macro-economy or the national social environment, while the third component contains challenges associated with the use of technology and data in SCM (Awad & Nasser, 2010a; Awad & Nasser, 2010b).

In Ghana, especially in its manufacturing sector where SCM is much carried out, there is little knowledge on challenges associated with integration into supply chain networks. This is logical as a result of lack of accessible empirical evidences on the subject from a Ghanaian point of view. Some studies (e.g. Adjei et al., 2013; Annan et al., 2013; Otchere et al., 2013; Sarpong et al., 2013; etc.) have been conducted on SCM and its challenges, but these studies are not fine-tuned

to integration into supply chain networks. Moreover, challenges identified in most related studies are not placed in components that serve as a basis of knowing which cluster of challenges hinder integration into supply chain networks most (Awad & Nasser, 2010a). Generally too, academic debate on the subject leaves much to be desired in view of the limited number of studies conducted on it. In view of these gaps in the literature and the need to contribute to their remedy, this study is conducted using data from Ghana's manufacturing sector.

In our previous study, we confirmed these three components of challenges in the contexts of manufacturing firms in Ghana. However, evidences provided in our previous study gives little information on the nature of effect made by each of these components on integration into supply chain networks. We therefore conduct this study to fill this gap in our investigation. This study is conducted based on the following alternative hypotheses:

H_1: Each of the components of challenges makes a significant negative correlation with integration into supply chain networks.

H_2: The relationship between each of the components of challenges and integration into supply chain networks is better expressed using ordinary least squares regression analysis.

METHODS AND MATERIALS

This study adopts a quantitative research approach in view of the need to use inferential statistical tools to test the hypotheses formulated. Ordinary least squares regression analysis is a quantitative statistical tool; hence its application is primarily expected to take place in a quantitative study (Rice, 1995). The advantage of using the OLS regression is that it estimates the sign and degree of effect made by each component of challenge. The PCA used in our previous study only classifies the components and provides limited information on the degree of influence made by each component.

The population of this study was supply chain management employees in the head offices of selected manufacturing firms in Ghana. These chosen firms are Accra Brewery Limited, Tulow Oil, Fan Milk, Ash Foam Ghana, Ghana Cement, and Newmont Ghana Limited. These firms were chosen because their supply chain processes are regular and rigorous in them. Moreover unlike other manufacturing firms, access to data was guaranteed with these firms. The sampling frame of the study was made up of senior management members working at the head offices of the firms. The study was limited to the head offices because we assumed that data from the head offices would reflect situations of supply chain management across all branches in Ghana. Members of the sampling frame were also required to have worked for at least two (2) years in their respective firms, ensuring that their responses were based on ample experience with the firm's supply chain processes.

The sampling frame of this study had 554 employees. By using Krejcie & Morgan's (1970) sampling principle and table, it was realised that a sample size of 226 people corresponds to the number of members in the sampling frame. Yet, the PCA works best with a sample size of at least 300 (Ringner, 2008). Hence, the sample size of 226 was increased to 350, making room for nonresponses. Krejcie & Morgan (1970) agree with this upward adjustment of sample size. The sample size was determined using the balloting method of the simple random sampling method. This sampling procedure was used in view of the interest of the researchers to make the sample representative of the study population by giving each member an equal chance of being selected into the sample.

A self-administered questionnaire was used to collect data. This instrument was designed to measure four constructs, namely micro-environment challenges, macro-environment challenges, technical challenges and integration into supply chain networks. In this study, integration into supply chain network is simply designed as "Integration". Items used in this respect were borrowed from the study of Awad & Nassar (2010a) as seen in Table 6 in the appendix. Measurement was done on a five-point likert scale [strongly disagree (1); disagree (2); neutral (0); agree (4); strongly agree (5)]. Some measures were taken to ensure that this instrument was valid and reliable. Firstly, it was submitted to some research experts on the subject for review and validation. Secondly, it was used in a pilot study on a small sample taken from the target population. This pilot study made way for improving the validity of the instrument.

Data was collected by both hand and electronic (e-mail) deliveries of questionnaires. Out of 350 questionnaires administered, 323 were completed but 312 were incorporated into data analysis. This means that 11 questionnaires were discarded owing to response errors that could not be rectified. In essence, an appreciable response rate of 89% was realised in this study. A reliability coefficient of 0.873 was also realised using SPSS Version 21. Evidently, the instrument used in data collection was reliable.

Data was analysed generally with SPSS Version 21. This statistical tool was used in view of its robustness for quantitative data analysis, precisely OLS regression, which was basically used to analyse data. The first hypothesis was analysed using Pearson's correlation. This tool was used because it is generally used to confirm the existence of a relationship among two continuous and normally distributed variables (Rice, 1995). The second hypothesis was tested using OLS regression. The OLS regression analysis was also used because data employed were continuous and normally distributed. The OLS regression analysis builds on evidences reached using the Pearson's correlation test (Rice, 1995). Results of the study are presented in the next section.

RESULTS

To start with, this study assesses the degree of effects by challenges on integration into supply chain networks in manufacturing firms in Ghana. Thus the study examines the extent to which each component of challenges influences integration into supply chain networks. This section presents results of the study. Table 1 shows the test of normality of data. This test is used to verify if data employed in this study was sourced from a normally distributed population.

Table 1: Tests of Normality

	Shapiro-wilk		
	Statistic	**Df**	**P-Value**
Micro-environment	.140	312	.653
Macro-environment	.250	312	.198
Technical challenges	.153	312	.511
Integration	.214	312	.267

Table 1 shows a test for the normality of data. The default hypothesis is that data associated with each construct is sourced from a normally distributed population. If this hypothesis should be retained, the p-value of each construct must be equal to or greater than the chosen level of significance, which in this study is 5%. From the table, the p-value of each construct is greater than 5% ($p > .05$). This suggests that data used in this analysis was drawn from a normally distributed population. This sets the foundation for reaching valid conclusions in this study. In the next table, the correlation matrix of the study's constructs is shown.

Table 2: Correlation Matrix

	Micro-environment	Macro-environment	Technical Challenges	Integration
Micro-environment	1	.670*	.425	-.954**
Macro-environment	.670*	1	.062	-.799**
Technical challenges	.425	.062	1	-.395
Integration	-.954**	-.799**	-.395	1

***Correlations significant at 5% significance level

Table 2 shows the correlation matrix of the four constructs of the study. It can be seen that each component of challenge is negatively correlated to Integration. Thus the first component of challenges designated *Micro-environment* significantly negatively correlates to Integration at 5% significance level, r (312) = -0.954, p < .05. Moreover, *macro-environment* challenges make a negative and significant correlation with Integration, r (312) = r (312) = -0.799, p < .05. However, the effect made by this construct on Integration is smaller relative to the effect made on it by *micro-environment* challenges. Technical challenges make the least (weak) but negative correlation with Integration, r (312) = -0.395, p < .05. The correlations indicate that integration into supply chain networks is significantly hindered by each of the components of challenges. The higher the level of each component of challenge experienced, the more difficult it becomes to integrate into supply chain networks. Tables 3 to 5 come with an OLS regression that better expresses these relationships.

Table 3: Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-watson
1	.954[a]	.910	.910	.02219	
2	.978[b]	.956	.956	.02541	2.021
3	.980[c]	.960	.960	.01602	2.063

a. Predictors: (Constant), Micro-environment
b. Predictors: (Constant), Micro-environment, Macro-environment
c. Predictors: (Constant), Micro-environment, Macro-environment, Technical challenges
d. Dependent Variable: Integration

Table 3 shows the model summary of the prediction of Integration by each of the three components of challenges. In the first model, Micro-environment challenges account for 91% of the total variation. In the second model, Micro-environment and Macro-environment challenges account for 95.6% of the total variation. This means that *Macro-environment* alone accounts for just 4.6% of the total variation. In the third model, Micro-environment, Macro-environment, Technical challenges account for 96% of the total variation. Hence, technical challenges account for 0.4% of the variation. Since the error term only accounts for 4% of the total variation, these three components of challenges largely influence integration into supply chain networks. Yet, a greater part of the influence comes from Micro-environment challenges.

Table 4: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	326.218	1	326.218	3142.515	.000[b]
	Residual	32.180	310	.104		
	Total	**358.398**	**311**			
2	Regression	342.698	2	171.349	3372.394	.000[c]
	Residual	15.700	309	.051		
	Total	**358.398**	**311**			
3	Regression	344.026	3	114.675	2457.516	.000[d]
	Residual	14.372	308	.047		
	Total	**358.398**	**311**			

a. Dependent Variable: Integration
b. Predictors: (Constant), Micro-environment
c. Predictors: (Constant), Micro-environment, Macro-environment
d. Predictors: (Constant), Micro-environment, Macro-environment, Technical challenges

Table 4 shows the ANOVA test associated with each model extracted in Table 3. The ANOVA test indicates whether the use of OLS regression improves the researchers' ability to relate the constructs of challenges to Integration. At 5% significance level, the test is significant for each model ($p < .05$). This means that OLS regression better expresses the relationship between each of the constructs and Integration. Table 5 shows the coefficients of the OLS regression.

Table 5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval For B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	5.799	.070		83.364	.000	5.662	5.936		
	Micro-environment	-.784	.014	-.954	-56.058	.000	-.811	-.756	1.000	1.000
2	(Constant)	6.118	.052		118.139	.000	6.016	6.220		
	Micro-environment	-.624	.013	-.760	-47.357	.000	-.650	-.599	.550	1.817
	Macro-environment	-.208	.012	-.289	-18.010	.000	-.231	-.186	.550	1.817
3	(Constant)	6.233	.054		115.093	.000	6.127	6.340		
	Micro-environment	-.584	.015	-.710	-39.504	.000	-.613	-.555	.403	2.484
	Macro-environment	-.229	.012	-.318	-19.500	.000	-.252	-.206	.490	2.041
	Technical challenges	-.049	.009	-.071	-5.334	.000	-.067	-.031	.729	1.372

a. Dependent Variable: Integration

Table 5 shows the coefficients of the prediction of Integration by each of the three constructs. In the first model, Micro-environment significantly predicts Integration at 5% significance level ($t = -56.06$, $p < .05$). In the second model, Macro-environment significantly predicts Integration at the same level of significance ($t = -19.50$, $p < .05$). In the third model, technical challenges significantly predict Integration at 5% significance level ($t = -5.33$, $p < .05$). As seen in Table 2, the effects made on Integration by each construct of challenges are negative. This is confirmed by the negative signs of the coefficients of each construct in Table 5. The relationship between Integration and each of the constructs is expressed as follows:

Integration = 6.23 – 0.58*Micro-Environment – 0.23*Macro-Environment – 0.05*Technical Challenges

The above equation indicates that each of the constructs or components of challenges make a negative effect on integration. Thus integration into supply chain networks is hindered as each of these challenges is encountered. Yet, the validity of this result is based on two statistical requirements. The first one is the need to ensure that the constructs do not have collinearity among them. The second requirement demands that there is independence of error among the constructs. The Variance Inflation Factor (VIF) values in Table 5 and the Durbin-Watson statistic in Table 3 respectively confirm that these requirements are satisfied. The general rule of thumb is that the VIF must be less than 5 and the Durbin-Watson statistic must be close to 2. These two requirements are satisfied. Hence, results of this study are sufficiently valid.

DISCUSSIONS

The three components of challenges associated with integration into supply chain networks have been identified in some previous studies (e.g. Awad & Nasser, 2010a; Awad & Nasser, 2010b; Carter et al., 2009), including ours. At this level, studies only provide evidence on items of each component and the amount of influence made by it through the use of PCA. This study builds on this evidence by providing information on the nature and sign of the effects of each component

on Integration. In this respect, the first component of challenges designated *micro-environment* negatively correlates to Integration, r (312) = -0.954, $p < .05$. Moreover, *macro-environment* challenges make a negative correlation with Integration, r (312) = r (312) = -0.799, $p < .05$. Technical challenges make the least (weak) and negative correlation with Integration, r (312) = -0.395, $p < .05$. The use of OLS regression analysis enabled us to better relate each component to Integration. In this respect, each component significantly predicts Integration at 5% significance level ($p < .05$). Micro-environment challenges account for 91% of the total variation in terms of the OLS regression. Macro-environment challenges account for 4.6% of the total variation. Technical challenges account for 0.4% of the total variation. Evidently, Micro-environment challenges (i.e. challenges relating to the internal supply chain structures and operations of firms) make an overwhelming proportion of the influence on Integration.

Results in this study harmonise with evidences reached in our previous study in terms of the size of variation accounted. Thus the component *micro-environment* produced the highest variation (53.7%) in our previous study through PCA, and this evidence is consistent in this study, though this study yields a higher variation of 91% for this component. Moreover, the second and third components respectively yield the second highest and least amount of variation in our previous study and in this one. This consistency extends to other previous studies (e.g. Awad & Nasser, 2010a; Awad & Nasser, 2010b; Carter et al., 2009) conducted on the subject in foreign country contexts.

Based on results reached in this study, organisations might wish to prioritise each component of challenges in terms of remedying them. In this respect, they must consider the amount of variation accounted by each component in the OLS regression. Organisations can however prioritise individual challenges for remedy based on evidences produced in our previous study. In this situation, extraction values in the communalities table of the PCA can be used to make decisions. The larger the extraction value of a variable, the higher the need to give it priority in remedying the challenges.

CONCLUSIONS AND RECOMMENDATIONS

The three components of challenges, namely micro-environment, macro-environment, and technical challenges are confirmed to negatively correlate to integration into supply chain networks among manufacturing firms. The first component of challenges designated *Micro-environment* negatively correlates to Integration, r (312) = -0.954, $p < .05$. Moreover, *macro-environment* challenges make a negative correlation with Integration, r (312) = r (312) = -0.799, $p < .05$. Technical challenges make the least (weak) and negative correlation with Integration, r (312) = -0.395, $p < .05$. These correlations imply that integration into supply chain networks is significantly hindered by challenges relating to firms' micro or internal environment, macro or national environment, and application of technologies and data. Invariably, the higher the level of each component of challenge experienced, the more difficult it becomes to integrate into supply chain networks.

The use of ordinary least squares regression enabled us to better relate each component to Integration. In this respect, each component/construct significantly predicts Integration at 5% significance level ($p < .05$). Micro-environment challenges account for 91% of the total variation in terms of the OLS regression. Micro-environment and Macro-environment challenges account for 95.6% of the total variation, meaning that Macro-environment alone accounts for 4.6% of the total variation. Micro-environment, Macro-environment, Technical challenges account for 96% of the total variation; so Technical challenges account for 0.4% of the total variation. Evidently, Micro-environment challenges (i.e. challenges relating to the internal supply chain structures and operations of firms) make an overwhelming proportion of the influence on Integration.

In simple terms, integration into supply chain networks by manufacturing firms is mostly hindered by micro-environment challenges, or issues relating to the internal organisational structures and processes of SCM, followed by macro-environment challenges, and technical challenges.

To maximise the effectiveness of integrating into supply chain networks, managements of manufacturing firms must remedy challenges found in each component based on the gravity of influence made by each of them. So, the first component (micro-environment) deserves the priority of managements. This is because remedy of challenges in this component would eliminate 91% of the hindrances associated with integrating into supply chain networks among the manufacturing firms. However, it does not mean that a remedy of the other two components of challenges is not relevant to effective integration into supply chain networks. Of course, managements have little control over macro-environment challenges; so they may need to consider remedying the third component of challenges after considering the first component.

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APPENDIX

Table 6: Constituents of Components

SN1	Component 1	SN2	Component 2	SN3	Component 3
1	Transaction cost	1	Business process integration	1	Data and information integration
2	Strategic flexibility management	2	Culture and change	2	Application integration
3	Strategic planning management	3	Supplier competence requirement	3	Extranet adoption
4	Customer order management	4	Business transformation oriented to globalization		
5	Logistic management	5	Effect of globalization		
6	Operation flexibility				
7	Measure of SC benefits				
8	Standard of trade				
9	Procurement management				
10	Enterprise integration				